School of Engineering and Applied Sciences

B. Tech Computer Science and Engineering

AY: 2017-2018

Department of Computer Science and Engineering
SRM University-AP, Amaravati

Department of Computer Science Engineering
SRM University-AP

Semester I

CODE	COURSE NAME	CREDIT	L - T - P
COM101 (HS)	Introduction to Communication	3	3-0-0
ECO122 (HS)	Principle of Economics	3	3-0-0
BIO101 (BS)	Introduction to Biology	4	2-0-2
CHE101 (BS)	Principle of Chemistry	4	2-0-2
MAT141 CSEC	Discrete Mathematics	3	3-0-0
CSE 101 (ES)	Introduction to Computer Science and Programming	5	3-0-4
	Total	22	

Semester II

CODE	COURSE NAME	CREDIT	L - T – P
EGL101 (HS)	English	3	3-0-0
ECO221 (HS)	Economics	3	3-0-0
MAT111 (BS)	Single-variable calculus	3	3-0-0
PHY111 (BS)	Introduction to Classical Mechanics	4	3-0-2
ENG111 (ES)	Basic Electronics	4	3-0-2
CSE103 (ES)	Introduction to Electrical Engineering and Computer Science	4	2-0-2
CDC1002	Soft Skill 1	1	1-0-1
	Total	22	18-0-7

Semester III

CODE	COURSE NAME	CREDIT	L - T – P
MAT 151 (BS)	Linear Algebra	3	3-0-0
HS	Environmental Science	3	2-0-2
ENG 101 (ES)	Engineering Fundamentals	3	3-0-0
PHY 112 (BS)	Introduction to Electricity and Magnetism	3	2-0-2
CSE 223	Data Structures and Algorithms using C	4	3-0-2
CSE 221	Digital Systems Design	4	3-0-2
CDC 1002	Soft Skill 2	1	1-0-0
	Total	21	17-0-8

Semester IV

CODE	COURSE NAME	CREDIT	L - T – P
BS	Multi Variable Calculus	3	3-0-0
BS	Signals and Systems	3	3-0-0
CSEC	Design and Analysis of Algorithms	4	3-0-2
CSEC	Computer Organization and Architecture	4	3-1-2
CSEC	Object Oriented Programming	4	3-0-2
CDC	Soft Skill 3	1	1-0-0
	Total	19	16-0-6

Semester V

CODE	COURSE NAME	CREDIT	L - T – P
ES	Probability and Statistics	3	3-0-0
CSEC	Operating Systems	4	3-0-2
CSEC	Formal Languages and Automata Theory	3	3-0-0
CSEC	Computer Networks	4	3-0-2
CSESE	CS Stream Elective 1	4	3-0-2
CDC	Soft Skill 4	P/F	1-0-0
	Total	18	16-0-6

Semester VI

CODE	COURSE NAME	CREDIT	L - T – P
CSE 304	Database Management Systems	4	3-0-2
BS	Differential Equations	3	3-0-0
CSE 305	Software Engineering	4	3-0-2
CSESE	CS stream Elective 2	4	3-0-2
CSE 306	Compiler Design	4	3-0-2
PR	UROP	3	0-0-6
CDC	Soft Skill 5	P/F	1-0-0
		22	16-0-14

Semester VII

CODE	COURSE NAME	CREDIT	L - T – P
CSESE	CS Stream Elective 3	4	3-0-2
CSETE	CS Technical Elective 1	4	3-0-2
OE	Open Elective 1	3	3-0-0
OE	Open Elective 2	3	3-0-0
PR	Capstone Project Phase I	6	0-0-12
		20	12-0-16

Semester VIII

CODE	COURSE NAME	CREDIT	L - T – P
CSESE	CS Stream Elective 4	4	3-0-2
CSETE	CS Technical Elective 2	4	3-0-2
OE	Open Elective 3	3	3-0-0
PR	Capstone Project Phase II	6	0-0-12
		17	9-0-16

SPECIALIZATION STREAMS

1. Artificial Intelligence and Machine Learning

a. Introduction to Machine Learning
b. Principle of Soft Computing
c. Visual Information Processing
d. Artificial Intelligence

2. Cyber Security

a. Network Security
b. Mobile and Wireless Security
c. Internet Protocols and Networking
d. Introduction to Cryptography

3. Data Science

a. Introduction to Data Science
b. Big Data
c. Machine Learning
d. Inference and Representation

GENERAL COMPUTER SCIENCE ELECTIVES

1. Data and Web Mining
2. Natural Language Processing
3. Image Processing
4. Human Computer Interaction
5. Advanced Computer Architecture
6. Distributed Operating Systems
7. Fog Computing
8. Parallel Algorithms
9. Web Services
10. Advanced Database Management Systems
11. Complexity Theory
12. Computer Graphics and Multimedia

13. Advanced Data Structures and Algorithms

MINOR PROGRAMME

CSE Dept. offers Minor in Computer Science and curriculum is given below.

Sl. No.	Subject Name	L-T-P	Credit
1	Object oriented programming with Java	3-0-2	4
2	Algorithm Analysis and Design	3-0-2	4
3	Web Technology	3-0-2	4
4	Database Management Systems	3-0-2	4
5	Software Engineering	3-0-2	4

SEMESTER I

SEMESTER – I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
COM 101	Introduction to Communication	C	3	0	0	3

Course Objective: Introduction to Communication is designed to help students with the principles and practice of effective oral communication skills. This course will help students through formal and informal speaking activities. Strategies for effective communication in social, business, and professional situations are examined. In all speaking assignments, articulation and the best way to frame ideas will be covered. The course objectives are for students to demonstrate an understanding of the value of rhetorical speaking skills; Paraphrase and cite research correctly; write and speak well-developed, clear, unified ideas with appropriate college-level language choices; Demonstrate a growing understanding of critical thinking in speaking, writing and in public situations.

UNIT I: Rhetoric and Public Speaking

Rhetoric, Critical Thinking and Public Speaking; Thinking Outside the Box; How to Deliver a Speech; Fundamentals of Persuasion.

UNIT II: Nonverbal Communication

Nonverbal Communication; Spatial distance, eye contact and appearances; How nonverbal communication is more important than words.

UNIT III: Communication and the Media

Persuasion and the media; Radio, television, film, social media and the internet; How the media sells ideas, images, products and life styles; Fundamentals of Informative/Scientific Speeches and Research; The Heart of the Speech – Powerful Narratives; The Power of Narrative.

UNIT IV: Small Group Communication

Small group communication; Leadership, conflict and persuasion in groups; The importance of small groups in business; Dr. A. Fisher's Fundamentals of Small Groups; Group Problem Solving; Learning to say no – don't say you will when you won't, don't say yes and then don't do it, be true to your word.

UNIT V: Persuasion, Ideology and Media Bias.

Advanced Rhetoric; Ideology; Persuasive Fallacies; How to Construct a Persuasive Speech; How to Present Scientific Data in a Speech; Unmasking Media Bias and Ideology; Full circle – the dangers of rhetoric and ideology.

Books of Study

1. Communication: Principles for a Lifetime. Beebe, Beebe and Ivy, 6th Edition, Pearson Publishing.

Books of Reference

1. Qualitative Communication Research Methods (2011) Bryan C. Taylor and Thomas R. Lindlof. Sage Publications, New Delhi, India, 3rd Edition.
2. The Fundamentals of Small Group Communication (2008) Scott A. Myers and Carolyn M. Anderson. Sage Publications, New Delhi, India.

SEMESTER – I

SUBJECT CODE	SUBJECT TITLE	CORE/ELECTIVE	CREDITS			
			L	T	P	C
ECO 122	Principles of Economics	Elective	3	0	0	3

UNIT I: Introduction

Nature and scope of Economics, Principles of Economics, Production Possibility Frontier, opportunity Costs, Comparative Advantage and Scope for Trade.

Demand and Supply curves, Equilibrium, Shift in curve versus movement along the curve, Elasticity of Demand and Supply.

Changes in equilibrium in response to policy changes, income, tastes and supply "shocks"

UNIT II: Consumer Behaviour

Consumer preferences and Indifference curve analysis – substitution, income and price effect.

UNIT III : Production and cost

Production, short- run production function and returns to factor – Average-marginal relationship, long – run production function and laws of return to scale- role of technology.

Cost function and cost structure of a firm in the short- run, long run cost function and cost structure.

UNIT IV: Types of markets

Perfect competition including shut-down and break-even points. Monopoly. Monopolistic competition and product differentiation.

UNIT V: Equilibrium in the short, medium and long run

Short-run equilibrium: The Goods market, the money market and General equilibrium (IS-LM)

Medium-run equilibrium: The labour market General Equilibrium (AD-AS)

Long-run equilibrium: Introduction to growth, capital accumulation and growth, technological progress and growth.

Unit VI: The open economy (International trade)

Openness in goods and financial markets, the goods market, the financial markets and General equilibrium. Exchange rate regime.

Books of study:

1. Principles of microeconomics, N. Gregory Mankiw, Publisher: Cengage Learning 5th edition.
2. Macroeconomics, Oliver Blanchard and David R Johnson,Publisher: Pearson; 6thedition.

Books of reference:

1. Intermediate Microeconomics: A Modern Approach, Hal R. Varian, Affiliated East-West Press Pvt. Ltd., 8thedition.
2. Principles of Macroeconomics with CourseMate, N. Gregory Mankiw, Cengage India, 6thedition.

SEMESTER - I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
BIO 101	Introduction to Biology	C	2	0	2	4

UNIT I: Basic Cell Biology

Cells: Cell theory, prokaryotes and eukaryotes, cell structure, composition and function, cellular organelles. Biomolecules: carbohydrates and lipids.
Cellular energy: ATP, Cellular transport: pumps, channels and transporters.

UNIT II: Protein Structure and Function

Protein structure: Amino acids, Primary, secondary and tertiary structures. protein folding, protein secretion and localization, protein modification and degradation. Introduction to Enzymes: classification, kinetics, synthesis and characterization.

UNIT III: Basic Molecular Biology

Nucleic acids, DNA: structure and function, RNA: types, structure and function. Flow of genetic information: replication, transcription and translation. Regulation of gene expression. Molecular biology tools: recombinant DNA (rDNA) technology and DNA sequencing.

UNIT IV: Cellular Signaling and Cancer

Cell cycle. Signaling molecules, Signaling pathways: Transmembrane receptor, Intracellular receptor, nuclear hormone receptor. Signaling to environmental stress: sensory systems and immune system. Introduction to Cancer Biology; nature, types, metastasis, diagnostics and treatment.

UNIT V: Applied Microbiology

Microbial Biotechnology: microbial growth and fermentation, large-scale production, generation of microbial-based antibiotics, microbial-based nano particles and their characterization. Industrial and environmental applications: dairy, bio-fuels, bioremediation.

Books of Study

1. Thrives in Biochemistry and Molecular Biology, Edition 1, 2014, Cox, Harris, Pears, Oxford University Press.
2. Exploring Proteins, Ed. 1, 2014, Price and Nairn,Oxford University Press.
3. Thrives in Cell Biology, Ed. 1, 2013, Qiuyu Wang, Cris Smith and Davis, Oxford University Press.
4. Metallic Nano crystallites and their Interaction with Microbial Systems, Ed. 1, 2012, Anil K. Suresh, Springer Netherlands.

Books of References

1. The cell: a molecular approach. Cooper, G. M., Hausman, R. E. (2009). ASM Press, Washington D. C.
2. Lehninger principles of biochemistry. Lehninger, A. L., Nelson, D. L., &Cox,M. M. (2000), Worth Publishers, New York.
3. Principle and techniques of biochemistry and molecular biology, Wilson, K., Walker,J. (2005). 6th edn. Cambridge University Press, Cambridge.
4. Kuby Immunology, Ed. 5, 2006, Kindt, Goldsbyand Osborn, W. H Freeman & Co (Sd).
5. Molecular Cell Biology, Ed. 8, 2016, Harvey Lodish, Arnold Berk and Chris A. Kaiser,W. H Freeman & Co (Sd).
6. Microbial Biotechnology: Principles and Applications, Ed. 1, 2006, Yuan Kun Lee, World Scientific Publishing Co Pt. Ltd.

SEMESTER - I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CHE 101	Principles of Chemistry	C	2	0	2	4

Unit I: Chemical Bonding

Ionic, covalent, and metallic bonds. Theories of bonding: Valence bond theory, nature of covalent bond, sigma (σ) bond, Pi (π) bond. Hybridization: Types of hybridization, sp, sp2, sp3, sp3d, d2sp3. Shapes of molecules (VSEPR Theory): $BeCl_2$, CO_2, BF_3, H_2O, NH_3, CH_4, PCl_5, XeF_2, SF_6, XeF_4. Molecular orbital theory: Linear combination of atomic orbitals (LCAO Method), bond order, homo- (H_2, O_2, N_2) and heteronuclear diatomic Molecules (NO, CO). Non-covalent interactions: Van der Waals interactions, dipole-dipole interactions, and hydrogen bonding.

Unit II : Phase Rule and Kinetics

Phase rule: Introduction. Definition of the terms used in phase rule with examples. Application of phase rule to water system, sulphur system and lead-silver system. Kinetics: Order and molecularity of reactions, zero order, first order and second order reactions.

Unit III : Water Technology

Standards for drinking water. Methods of Treatment of water for domestic and industrial purposes: Sedimentation, Coagulation, Filtration, Sterilization, Break point chlorination. Determination of Hardness of water by EDTA method. Demineralization of water. Softening of water: Lime-soda Process, Ion exchange process, Zeolite process. Boiler Troubles: Priming, Foaming, Scale, Sludge, Corrosion, Caustic Embrittlement.

Unit IV : Polymer Chemistry

Classification of polymers: Natural and synthetic. Thermoplastic and Thermosetting. Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

Unit V : Electrochemistry

Arrhenius theory of electrolytic dissociation, classification of electrolytes; degree of dissociation of acids, dissociation constant of weak acids, concept of pH and pOH, buffer solutions, solubility product, common ion effect, indicators and theory of acid-base indicators; conductance of solutions- specific, molar and equivalent conductance, variation of molar conductance with dilution for strong and weak electrolytes; Migration of ions-Kohlrausch's law of independent migration of ions, Ostwald's dilution law; Nernst equation for single electrode and electrochemical cells.

Books of Study

1. A. Bahl and B. S. Bahl, G. D. Tuli, Essentials of physical chemistry, S Chand Publication, 2014, ISBN: 8121929784.
2. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller and F.A. Armstrong Shriver and Atkins' Inorganic Chemistry, 5thEd., Oxford University Press,London, 2010, ISBN 978-1-42-921820-7.
3. Atkins, P.W.; de Paula, J. Physical chemistry, 8th ed., 2006 Oxford University Press. ISBN 0-19-870072-5.
4. B. R. Puri, L. R. Sharma & M. S. Pathania, Principles of Physical Chemistry, 46th Ed.,2013, Vishal Publication Company.
5. F.W. Billmeyer, Text Book of Polymer Science, 3rd Ed., John Wiley & Sons, New York, 2003.

Books of Reference

1. J. Bard and L.R. Faulkner, Electrochemical methods –Fundamentals andApplications, 2ndEd., John Wiley and Sons,2001.
2. Jain P.C. & Monika Jain, Engineering Chemistry, Dhanpat Roy & Sons, 2015, ISBN 10: 8187433175 / ISBN 13: 9788187433170.

SEMESTER - I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 141	Discrete Mathematics	C	3	0	0	3

Scope & Aim of this course: This course is an introduction to discrete mathematics for the computer science engineers. The prerequisite for this course is the first course on set-theory. The objective is to equip the students with the mathematical definitions, proofs and applicable methods.

Unit I : The Foundations: Logic and Proofs
Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

Unit II: Set Theory
Laws of set theory, Set Operations, Functions, Sequences and Summations, Matrices.

Unit III: Elementary number theory, Induction and Recursion
Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruences; Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction.

Unit IV: Counting principles
The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations.

Unit V : Introduction to Graph Theory
Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems.

Books of Study

1. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh edition, Tata McGraw-Hill, 2012.
2. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

Books of Reference

1. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Ed., Tata McGraw-Hill, 1999.
2. M. K. Venkataraman, N. Sridharan, and N. Chandrasekaran, Discrete Mathematics, National Publishing Company, 2003.

SEMESTER - I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 101	Introduction to Computer Science and Programming	C	3	0	4	5

Unit I

Introduction to Python: Knowledge, Machines, Languages, Types, Variables Operators and Branching -– Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions Newton-Raphson – Functions: Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numerics, Files

Unit II

Tuples and Lists: Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries , Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples

Unit III

Classes and Inheritance: Object Oriented Programming, Class Instances, Methods Classes Examples , Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, Adding another Class, Using Inherited Methods, Gradebook Example, Generators

Unit IV

Computational Complexity: Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort

Unit V

Optimization and Knapsack Problem: Computational models, Intro to optimization 0/1 Knapsack Problem, Greedy solutions – Decision Trees and Dynamic Programming: Decision tree solution to knapsack Dynamic programming and knapsack, Divide and conquer – Graphs: Graph problems, Shortest path, Depth first search, Breadth first search

Unit VI

Stochastic Thinking: Rolling a Die, Random walks – Random Walks: Drunk walk, Biased random walks, Treacherous fields – Inferential Statistics: Probabilities, Confidence intervals – Monte Carlo Simulations: Sampling, Standard error Experimental Data: Errors in Experimental Observations, Curve Fitting, Goodness of Fit , Using a Model for Predictions

Unit VII

Machine Learning: Feature Vectors, Distance Metrics, Clustering – Statistical Fallacies: Misusing Statistics, Garbage In Garbage Out, Data Enhancement - Visualization of Data: Visualizing Results, Overlapping Displays, Adding More Documentation, Changing Data Display

Books of Study

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

Books of References

1. Python Programming using problem solving Approach by ReemaThareja, Oxford
   University, Higher EducationOxford University Press; First edition (10 June 2017),
   ISBN-10: 0199480173
2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher(2016)
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1st edition (6th February 2009)

SEMESTER-II

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
EGL 101	English	C	3	0	0	3

Course Objective: This course is designed to help students increase writing and verbal English skills with regular practice and analysis of effective writing. This course will cover English in social, business, scientific and professional situations as well as public speaking.

Unit I : Horizontal and Vertical Writing
Students learn the differences between Vertical and Horizontal Writing. Readings from the best writers illustrate the best English writing.

Unit II: Basic English Concepts and Introduction to Linguistics
Students learn by the practice of working on basic English concepts of writing and speaking.

Unit III: Creative Writing
Learning to express ideas in ways that persuasively and clearly help the readers/listeners understand the student's experiences.

Unit IV: Research Writing
The basics of how to write a research paper. Most students were (shockingly) never required to do a bibliography. They learn about thesis paragraphs, research, outlines, rewriting, editing and creating a bibliography.

Unit V: English Presentations
In this Unit, students learn to combine and synthesize their writing with presentation skills. Research papers and ideas are shared and presented to
small and large groups.

Text Books:

1. Communicative English – (A workbook) Cambridge University Press
2. Streets of Laredo by Larry McMurty (A novel), Simon and Schuster, 2010

References:

1. Oxford English Language Dictionary

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ECO221	Economics	C	3	0	0	3

Course Objective: The course will talk about e-commerce—since we observe in today's world that a real market where producers and consumers interact are becoming less common. This course will provide a broad overview of the economic theory and empirical analysis in the area of e-commerce.

UNIT I: Introduction

Relevance and potential of E-Commerce in India (Lecture notes)
E-commerce and its relevance to labour, credit and health care markets (Lecture notes)

UNIT II: Background Concepts

Perfect competition- Meaning, revenue of a competitive firm, Profit maximization and firms supply curve Monopolistic competition and product differentiation Competition with differentiated products. (Mankiw, chapters 14, 15 and 16). Monopoly pricing and price discrimination, Meaning, monopolies production and pricing decisions, price discrimination, advertisement.(PRN Sections 3.1, 3.2, 4.1) (SV Chapters 2, 3) Competition and oligopoly pricing, Cost of producing information. Cost and competition, market structure for information goods, pricing your product. (Shapiro and Varian, Chapter 2)
Market leadership- Network and positive feedback, demand side economies of scale, network externalities, collective switching costs, Generic strategies in network markets (Shapiro and Varian, Chapters 5, 7), PRN Section 12.4, Time Paths in the Diffusion of Product Innovations

UNIT III: Select E-Industries (10 hours)
Auctions:
Why are some goods auctioned and others sold at fixed prices?
Different auction platforms and what explains success of some platforms and failures of other platforms. Changes in business of auctions over the past two decades. Required websurfing: eBay, Yahoo!, Auctions on the Internet: What's Being Auctioned and How, Vickrey auctions in practice: From Nineteenth Century Philately to Twenty-First Century, E-commerce, Trust Among Strangers in Internet Transactions: Empirical Analysis of eBay's
Retail stores

How does the internet affect retail markets? Comparison of these markets with the traditional markets in terms of search costs and patterns of competition, Required websurfing: Amazon, Dell, Pcboost, Z-shops, Yahoo! Shopping, Autobytel, & Wal-mart, Emerging Landscape for Retail E-Commerce

UNIT IV: Introduction to Statistics and Econometrics

Definition of basic statistical concepts: mean, median, probability, conditional expectation, conditional probability (Lecture notes), Introduction to regression analysis (Lecture notes), Statistical Models and Shoe Leather

UNIT V: Sales Taxes and E-Commerce

The effect of sales taxes on the development e-commerce, Demand and supply effects of sales taxes, Sales taxes and internet commerce, ìTax Sensitivity and Home State Preferences in Internet Purchasing, In a World without Borders: the Impact of Taxes on Internet Commerce, Playing with Fire: Cigarettes, Taxes and Competition from the Internet, ìTaxation of Electronic Commerce

Books of study

1. Industrial Organization: Contemporary Theory and Practice by Pepall, Richards and Norman [PRN].
2. Information Rules by Shapiro and Varian [SV]
3. Principles of microeconomics, N. Gregory Mankiw, Publisher: Cengage Learning fifth edition.

Books of reference

1. Intermediate Microeconomics: A Modern Approach, Hal R. Varian, Affiliated East-West Press Pvt. Ltd., eighth edition
2. Electronic Commerce (Fourth Edition), Adesh k. Pandey : Pete Loshin
3. E-Business and E-Commerce Management, Dave Chaffey, 3rd Edition, 2009, Pearson Education Inc., New Delhi
4. E-Commerce fundamentals and Applications, Chan, Wiley India, New Delhi

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 111	Single Variable Calculus	C	3	0	0	3

Course Description: This course is an introduction to Single Variable Calculus to all engineering students. The objective is to equip the students with the knowledge of calculus and its applications

Unit I: Derivatives and Differentiation

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

Unit II: Approximations and their Applications

Measurement error of linear approximation, Quadratic approximation, Newton's method, 1st and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

Unit III: The Integral and Integration Theory

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

Unit IV: Different Integration Techniques and Application of Calculus

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

Unit V: Polar Co-ordinate systems and Infinite Series

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

Books of Study:

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India ,2005
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis, SpringerIndia,2007
3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.

Books of Reference:

1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999.
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
PHY111	Introduction to Classical Mechanics	C	3	0	2	4

Course Description: The course aims to cover the fundamental formalism and applications of classical mechanics. It mainly includes basic Newtonian mechanics and special theory of relativity.

Unit – I: Review of Newtonian Mechanics

Review of Scalars, Vectors and Kinematics, Newton's Laws of Motion and applications, Contact Forces, Static Friction, worked examples, Tension and springs, Pushing Pulling and Tension, Solving Pulley Systems, Hooke's Law and applications.

Unit – II: Circular Motion

Polar Coordinates, Position and Velocity Vectors, Angular Velocity, Uniform Circular Motion, Direction of the Acceleration, Period and Frequency, Angular Acceleration, Newton's Second law and circular motion, worked examples

Unit –III: Momentum and Impulse

Momentum and Impulse, Impulse momentum theorem, Conservation of Momentum, Momentum Diagrams, worked examples, Center of Mass and Motion of the Center of Mass, Center of Mass of 3 Objects, Center of Mass of a Continuous System, Center of Mass of a Uniform Rod and different objects, Velocity and Acceleration of the Center of Mass, Reduction of a System to a Point Particle, Center of Mass Trajectory.

Unit-IV: Work Energy and Collision

Kinetic Energy and Work in 1D, Work by a Constant Force, Work by a Non- Constant Force, Work-Kinetic Energy Theorem and related problems, Kinetic Energy and Work in 2D and 3D, Work-Kinetic Energy Theorem in 2D and 3D, Worked Example, Conservative and Nonconservative Forces, Path Independence - Gravity, Path Dependence – Friction, Potential Energy due to gravity and of a spring, worked examples, Principle of energy conservation and worked examples, Collision and its type. Collision in 1D and worked examples Collision in 2D and worked examples

Motion of a rigid body and moment of inertia, Parallel and perpendicular axis theorem, Moment of inertia of different objects, Torque and Angular momentum, worked examples

Unit-V: Gravitation

Central forces, Newton's Law of Gravitation, Principle of Superposition, Acceleration due to gravity and its variation, Gravitational Potential Energy, Kepler's Laws, hyperbolic and parabolic orbits, Satellites' Orbits and Energy, worked examples

Special Theory of Relativity : Michelson-Morley experiment, Postulates of special theory of relativity, Galilean and Lorentz transformations, Relative Velocity, Velocity in ground frame and moving frame. Length contraction and time dilation, Worked examples, Relativistic addition of velocities, Mass energy and Energy-momentum relation.

Books of Study:

1. MIT-- 8.01X online course material
2. University Physics with Modern Physics with Mastering Physics, (12th Edition) – Hugh D.Young, Roger A. Freedman and Lewis Ford (Publisher – Pearson Education)
3. Introduction to Classical Mechanics - R. G. Takwale, P. S. Puranik (Publisher – Tata McGraw- Hill Education)

Book(s) of Reference:

1. Classical Mechanics (2011) - Herbert Goldstein (Publisher – Pearson Education)
2. Classical Mechanics (2014) - J. C Upadhayaya (Publisher – Himalaya Publishing House)

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ENG111	Basic Electronics	C	3	0	2	4

Course Description: This course is designed to give basic understanding of basic principles ofvelectronics/concepts and devices to all engineering students

Unit I: Electrical Quantities and Their Measurement

Ohm's law, permanent magnet moving coil (PMMC) instrument, Ammeter and Voltmeter using PMMC, Measurement of resistance using Wheat Stone's Bridge and Kelvin's double bridge, measurement of capacitance using Schering's bridge and De Sautee's bridge, and measurement of inductance using Maxwell's bridge and Hay's bridge. Operation of the oscilloscope.

Unit II: Semiconductor Devices

Forward and reverse bias characteristics of PN junction diode. Design of half-wave, fullwave, bridge rectifiers, clipping and clamping using PN junction diode. Bipolar junction transistors (BJTs), common-base, common-collector and common-emitter configurations using BJTs. Voltage and current gain, transistor as amplifier and buffer. Photodiode and phototransistor.

Unit III: A.C. Circuits and Operational Amplifier

Phasor analysis, impedance and reactance, resonance, tuned circuits using R-L-C components, series reactance and resistance, parallel reactance and resistance. Characteristics of an operational amplifier, inverting and non-inverting op-amps, integrator and differentiator design using op-amp. Differential operational amplifier and commonmode rejection ratio.

Unit IV: Electronic Filters

Low and high frequency noise in electronic circuits, basic low-pass, high-pass, band-pass and band- reject passive filters design using resistor, capacitor and inductor. Fourier transform, magnitude and phase response, bandwidth, bode plots. Design and analysis of higher order filters. Active filter design using operational amplifier, applications of electronic filters.

Unit V: Digital Logic Fundamentals

Number systems: binary, decimal, octal and hexadecimal number systems, number system conversions. Logic gates: AND, OR, NOT, NAND, NOR, X-OR, X-NOR. Logic gates design using PN diodes. De Morgan's laws, Karnaugh maps. Basic combinational logic

blocks: half adder, half subtractor, full adder, full subtractor, multiplexer and de multiplexer.

Text books:

1. Principles of electronics by V K Mehta & Rohit Mehta, 2010 edition, S Chand and Co.Publisher, ISBN: 9788121924504.
2. Electronic devices and circuits by David A. Bell, 2008 edition, Oxford University Press, ISBN: 9780195693409.
3. Introduction to digital logic design by John P. Hayes, 1993 edition, Pearson Edition, ISBN: 9780201154610.

References:

1. Electronic measurements and Instrumentation by A K Sawhney, 2015 edition, Dhanpat Rai and Co., ISBN: 9788177001006.
2. Pulse, Digital and Switching waveforms by Mill man and Taube, 2011 edition, Tata McGraw Hill, ISBN: 9780071072724.

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE103	Introduction to Electrical Engineering and Computer Science	C	2	0	2	4

Course Description: This course gives some basic understanding of some advanced python programming concepts, circuit analysis, electrical network theorems and resonance and transient analysis

Unit I: Object oriented Programming Concepts using Python

Objects, Class, Method, Encapsulation, Data abstraction, Polymorphism, Inheritance. Object Oriented Design Principles and Patterns: Iterator Pattern, Decorator Pattern, Strategy Pattern

Unit II: State Machines Basics and Design using Python

Introduction to regular expressions, Finite state machines, Design state machine using python, Basic combination and abstraction of state machines, Terminating state machines and sequential compositions, Use case of state machine design using python

Unit III: Circuit Analysis

Review of KCL and KVL, Basic Circuit Terminology-Node, loop, mesh, circuit, branch and path. Ideal sources, Source transformation, Star-Delta transformation. AC analysis - Phasor, Complex impedance, complex power, power factor, power triangle, impedance triangle, series and parallel circuits.

Unit IV: Network Theorems

Network Theorems (A.C. and D.C Circuits) - Mesh and Nodal analysis, Superposition theorem, The venin's theorem, Norton theorem, Maximum Power transfer and, Reciprocity theorem.

Unit V: Resonance and Transient Analysis

Introduction to Resonance-series and parallel, half power frequency, resonant frequency, Bandwidth, Q factor. Transient Analysis-Step response, Forced Response of RL, RC & RLC Series circuits – Time Constant & Natural frequency of Oscillation.

Text Books:

1. Object-Oriented Programming in Python, by Michael H Gold wasser, David Letscher, Pearson publication 1st edition (29 October 2007).

2. Theory of Computer Science: Automata, Languages and Computation, by Mishra K.L.P Publisher: Prentice Hall India Learning Private Limited; 3rd edition (2006)
3. Fundamentals of Electrical Engineering, Second Edition, by Leonard Bobrow, Oxford University press,1996
3. Network Analysis, by G K Mithal, Khanna Publisher, Delhi (2003)
4. Fundamentals of Electric Circuits, by Charles K. Alexander and Matthew N.O. Sadiku, Publisher: McGraw Hill Education, 5th edition (1 July 2013).

Reference Books:

1. Programming Python: Powerful Object-Oriented Programming 4th, Kindle Edition by Mark Lutz (Author) Publisher: O'Reilly Media; 4 edition -14 December 2010)
2. Automata Theory, Languages and Computation (Bundle - Set of 2 books) Paperback Apr 2016 by John E. Hop croft (Author), Jeffrey D Ullman (Author), Rajeev Motwani (Author) Publisher: Pearson Education; Third edition (10 April 2016)
3. Electrical Engineering Fundamentals, Vincent Del Toro, Second edition, Prentice Hall India Learning Private Limited, 2014.
4. Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N.O. Sadiku, Mc Graw Hill Higher Education, Fifth Edition, 2013.
5. Principles of Electric Circuits Conventional Current Version, Thomas L. Floyd, Education Limited, Ninth Edition, 2009.
6. Engineering Circuit Analysis, by William H. Hayt (Author),Jack Kemmerly(Author), Steven M.Durbin (Author), Publisher: McGraw Hill Education, Eighth edition (August 2013).

SEMESTER - II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CDC 1002	Soft Skills-1	C	1	0	1	1

UNIT I - Interpersonal Skills

Understanding the relationship between Leadership Networking and Team work, Realizing Ones Skills in Leadership, Networking & Team Work, and Assessing Interpersonal Skills Situation description of Interpersonal Skill. Team Work Necessity of Team Work Personally, Socially and Educationally

UNIT II - Leadership

Skills for a good Leader, Assessment of Leadership Skills, Change Management, Exploring Challenges, Risking Comfort Zone, Managing Change

UNIT III - Stress Management

Causes of Stress and its impact, how to manage & distress, Understanding the circle of control, Stress Busters. Emotional Intelligence What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.

UNIT IV - Conflict Resolution

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V - Decision Making

Importance and necessity of Decision Making, process of Decision Making, Practical way of Decision Making, Weighing Positives & Negatives.

Reference Books:

1. Covey Sean, Seven Habit of Highly Effective Teens, New York, Fireside Publishers, 1998.
2. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
3. Thomas A Harris, I am ok, You are ok , New York-Harper and Row, 1972
4. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006

SEMESTER - III

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 151	Linear Algebra	C	3	0	0	3

Course Description: This is a basic subject on matrix theory and linear algebra. Emphasis is given to topics that will be useful in other disciplines, including systems of equations, vector spaces, determinants, eigenvalues, similarity, and positive definite matrices.

Unit I

Vector Space: Elimination, LU factorization, null-spaces and other subspaces, bases and dimensions, vector spaces, complexity

Unit II

Factorization: Orthogonality, projections, least-squares, QR, Gram–Schmidt, orthogonal functions

Unit III

Matrices: Eigenvectors, determinants, similar matrices, Markov matrices,ODEs, symmetric matrices, definite matrices,

Unit IV

Iterative methods: Defective matrices, SVD and principal-components analysis, sparsematrices and iterative methods, complex matrices, symmetric linear operators onfunctions.

Unit V

Applications: Matrices from graphs and engineering.

Books of Study:

1. G. Strang, Linear Algebra and Its applications, Nelson Engineering, 4th Edn., 2007
2. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall of India, 1996

Books of Reference:

1. S. Axler, Linear Algebra Done Right, 2nd Edn., UTM, Springer, Indian edition, 2010.
2. G. Schay, Introduction to Linear Algebra, Narosa, 1997.

SEMESTER - III

	SUBJECT TITLE		CREDITS

SUBJECT CODE		CORE/ ELECTIVE	L	T	P	C
HS	Environmental Science	E	2	0	2	3

Course Description: This course provides an integrated, quantitative and interdisciplinary approach to the study of environmental systems. Topics include Environment, Structure and functions in an ecosystem; Biosphere, Broad nature of chemical composition of plants and animals; Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land; Energy, Growing energy needs, energy sources; Biodiversity and its conservation; Environmental Pollution; Environmental Biotechnology; Social Issues and Environment covering, problems relating to urban living, climate change, environmental regulation, and environmental ethics.

UNIT I : Environmental Education, Sustainability, and Ecological Systems: How ecosystems works

Environmental Education, Concept of sustainability, Tragedy of the commons; Root causes of environmental crisis, Earth systems atmosphere, hydrosphere, Lithosphere, and Biosphere. Ecosystem structure and function, Ecological systems and major biomes, Water and nutrients cycles- Water cycle, phosphorous cycle, nitrogen cycle, Case study – Cape Town water crisis.

UNIT II: Biodiversity and its conservation

Biodiversity: -Why do we care? (Values of biodiversity); Threats to biodiversity; Saving Biodiversity–sustainable approaches; Case Study-The Last White Rhino; GMO; Technological advancement and biodiversity conservation.

UNIT III: Environmental Pollution and its role on global climate change and human health

Pollution–air, water, and soil pollution. Air pollution: Composition of air, Sources of air pollution, Primary and secondary pollutants, Air quality index (AQI), Effects of air pollution, Air pollution and infant mortality, Air pollution control: Sustainable strategies, Greenhouse gases; Carbon cycle; Global warming and climate change; Renewable and Non-renewable Energy sources Water pollution: Surface water, Groundwater, and Ocean pollution; Point and Non-points sources; Organic and inorganic nutrients pollution; Eutrophication; Microbial contamination; Oil pollution in the seas-Exxon Valdez Oil pill; Plastic pollution Soil Pollution: Chemical contamination, Major contributors of soil pollution (Coal ash, sewerage, Pesticides and herbicides, etc.)

UNITIV: Environmental Microbiology and Biotechnology

Environmental Microbiology: Microbes in our daily lives; Microbial life in air, water, and soil; Indicator microorganisms; Micro bialinteractions, signaling, biotransformation, and bioremediation; Molecular Ecology: The rare Biosphere; Microbial contribution to global climate change–Methane, and Nitrous oxide emissions; Global warming and microbial infectious disease.

UNIT V: Environmental ethics, Economics, policy development

Environmental ethics for a sustainable society ;Economics of pollution control, Carbon credits, taxes, and role in environmental protection; Environmental movements; Environmental protection acts in India; Sustainable Economic Developments: Challenges of developing nations, Political decision making for Environmental Protections. Case study-Chinese Environmental Protection Tax, Water resource tax, CNG vehicles in Delhi/Delhi odd-or-even rule.

Books of Study:

1. Basu.M,Xavier.S."FundamentalsofEnvironmentalStudies",1stedition,Cambridge, UniversityPress,2016.
2. Raina. M.Maier, IanL.Pepper,Charles.P."Environmental icrobiology"2ndedition, AcademicPress,2004.

References:

1. Danial. D. C. "Environmental Science", 8thedition,Jonesand Barlett Publishers, MA,2010.

SEMESTER – III

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ENG101	Engineering Fundamentals	C	3	0	0	3

UNIT I

Sources of Energy, Types of Prime Movers, Force, Mass, Pressure, Work, Power, Energy, Heat, Temperature, Internal Energy, Enthalpy, Efficiency, Zeroth Law, First Law, Thermo dynamic System, Different Types of Fuels, Non-Conventional Energy -Wind, Solar, Bio, Global Warming

UNIT II

Introduction-Fluids, Physical Properties of Fluids, Relationship Between Stress and Strain- Rate for Newtonian and Non-Newtonian Fluids, Description of Fluid Flow, Classification of Flows- Laminar and Turbulent Flows, Measurement of Flow.

UNIT III

Heat Engines-External, Internal, Carnot, Rankine, Otto, Diesel Cycles; Steam Boilers- Fire Tube, Water Tube Boilers, Valves; IC Engine-Components, 2 Stroke,4 Stroke, Engine Performance, Efficiency.

UNIT IV

Pumps Reciprocating, Rotary, Pump Efficiency; Air Compressors-Reciprocating/Rotary; Refrigeration and Air Conditioning-Principles of Working; Brakes, Clutches and Couplings, Drives-Transmission of Power-Belt Drive, Gear Drive, Chain Drive.

UNIT V

Mechanics of Materials-Engineering Materials, Material Properties- Tensile Strength, Toughness,Malleability,Hardness,Ductility,Stiffness,Brittleness,Elasticity,Plasticity,Creep , Fatigue, Failure, Stress-strain splots, failures

Books of Study:

1. Elements of Mechanical Engineering, S Trymbak Murthy, IK International Publishing, 2010.
2. Elements of Mechanical Engineering, RKRajput, Laxmi Publications Ltd, 2005.

References:

1. Elements of Mechanical Engineering, V.K. Manglik, PHI Publications,2013.
2. Elements of Mechanical Engineering, B. L. Theraja, S. Chand Ltd. 1999.
3. Elementsof MechanicalEngineering,Sadhu Singh, S.Chandand Company Ltd.2013.

SEMESTER – III

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
PHY 112	Introduction To Electricity and Magnetism	C	2	0	2	3

Unit I

Introduction to Vector Algebra: Gradient, Divergence and curl and their physical significances, Gauss and Stokes theorems, Vector operators in different coordinate (Curvilinear, Cartesian, Cylindrical and spherical) systems

Unit II

Electrostatics: Coulomb's law, Gauss law, Electric field, Electrostatic Potential, Potential energy of system of charges.
Boundary Value problems in electrostatics-solution of Laplace equation in Cartesian system, Method of image charge

Unit III

Dielectrics and Polarization: Electric dipole and dipole moment, Electric potential due to dipole, Electric intensity due to dipole, Polarization P, Electric displacement D, Electric susceptibility and dielectric constant, Bound volume and surface charge densities, Electric field at an exterior and interior point of dielectric.

Unit IV

Magneto statics: Biot-savart law, Ampere's law for force between two current carrying loops, Ampere's circuital law, Equation of continuity, Magnetic vector potential A, Energy density in magnetic field, magnetization of matter (B,H,M) Magnetic susceptibility and permeability, Hysteresis loss, B-H curve, Diamagnetic, paramagnetic and ferromagnetic substances.

Unit V

Electrodynamics: Time varying fields: Faradays law of induction, generalization of Amperes' law, Maxwell's equation (Differential and Integral form), Wave equation and plane waves in free space, Poynting theorem, Polarizations of plane wave, Microscopic form of ohm's law ($J=\sigma.E$)

Required Book:

1. Introduction to Electrodynamics (4rd Edition) - David J. Griffiths (Publisher - PHI Learning, Eastern Economy Editions, 2012)
2. Electricity and Magnetism (Reprints 2007, 1st Edition 2001) A. S. Mahajan, A. A. Rangwala, (Publisher - McGraw-Hill Education)

Reference Books:

1. Electricity and magnetism Edward M Purcell, David J Morin, "", 3rd edition, Cambridge University, 2013
2. Classical Electrodynamics (3rd Edition) - John David Jackson (Publisher – Wiley)

SEMESTER - IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 223	Data Structures and Algorithms using C	C	3	0	2	4

UNIT I

Introduction to C programming, identifiers, basic data types, constants, variables, keywords, operators: arithmetic, relational and logical, increment and decrement operators, conditional operator, assignment operators, Instruction: type declaration, Input-output, conditional, loop control, Arrays, Functions, pointers, dynamic memory management functions Derived types- structures- declaration, definition and initialization of structures, accessing member of structure, arrays of structures, structures and functions, pointers to structures, self-referential structures.

UNIT II

Introduction to data structures, Stacks and Queues: representation and application, implementation of stack and queue operations using C, Linked lists: Single linked lists, implementation of link list and various operation using C, Double linked list, circular list.

UNIT III

Trees: Tree terminology, Binary tree, Binary search tree, infix to postfix conversion, postfix expression evaluation. General tree, AVL Tree, Complete Binary Tree representation.

UNIT IV

Graphs: Graph terminology, Representation of graphs, Path matrix, BFS (breadth first search), DFS (depth first search),topological sorting, Shortest path algorithms.

UNIT V

Sorting and Searching techniques–Bubble sort, selection sort, Insertion sort, Quick sort, merge sort, Heap sort, Radix sort, implementation using C. Linear and binary search methods, implementation using C, Hashing techniques and hash functions.

Books of Study:

1. Data structure using C", Aaron M. Tenenbaum, YLangsamand MoscheJ. Augenstein, Pearson publication.
2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson publications, Second Edition Programming in C. P. Dey and M Ghosh ,Second Edition, Oxford University Press.
3. Programming with C, Byron Gottfried, Mcgraw hill Education, Fourteenth

reprint, 2016

References:

1. Fundamentals of data structure in C" Horowitz, Sahani and Anderson Freed, Computer SciencePress.
2. Fundamental of Data Structures, (Schaums Series) Tata-McGraw-Hill.
3. Data Structure- A Pseudo code approach with C , Gilberg and Forouzan, by Thomson publication

SEMESTER III

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE221	Digital Systems Design	C	3	0	2	4

UNITI

Digital Systems and Binary Numbers: Digital Systems Number systems and base conversions – Representation of signed Binary Numbers– Binary codes– Logic gates.

UNIT II

Boolean Algebra: Introduction to Boolean Algebra–Axioms and Laws of Boolean Algebra– Boolean functions–Canonical and StandardForms.Gate –Level Minimization: Introduction Two, Three, Four Variable K-map's – Don't Care Conditions – NAND and NOR Implementation

UNIT III

Combinational Logic: Introduction to combinational logic circuits – Binary adder and substractor – Look Ahead Carry Adder - Magnitude comparator – Decoders – Encoders – Multiplexers – DE multiplexers.

UNIT IV

Synchronous Sequential Logic: Introduction to sequential circuits–Latch–Flip Flop– SR,JK, T,D Flip Flops–FlipFlop excitation tables. Analysis of clocked sequential circuit, Registers and Counters: Registers –Shift registers –Ripple counters– Synchronous counters–Other counters.

UNIT V

Memory and Programmable Logic: Introduction to Programmable Logic Devices(PLD's) Programmable ROM(PROM) – Programmable Logic Array (PLA) – Programmable Array Logic (PAL).

Books of Study:

1. Digital Design with an Introduction to the Verilog HDL by M.Moris Mano and Michael D. Ciletti, 5th Edition.
2. Digital Principles and Applications by Leach, Paul Malvino, 5thEdition.

References:

1. Fundamentals of Digital Logic Design by Charles H.Roth, Jr. 5th Edition, Cengage
2. Digital Electronics by G.K. Kharate, Oxford University Press 3. Switching Theory andLogic Design by A. Anand Kumar, PHI, 2nd Edition.

Semester III

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CDC	Soft Skills 2	C	1	0	0	1

UNIT I: Motivation

Soldiers' Walk and The Japanese Fan (Activities on factors of motivation), Steps to ward off de-motivation

UNIT II : Creativity and Innovation

Short Film: Students would be encouraged to make a ten-minute documentary on various topics to enhance the power of aesthetics and precision. This activity is aimed at creating an interest in research and think out of the box.

UNIT III: Critical and Lateral Thinking

Fill Me Up, Stimulating Lateral Thinking, The Curious Case of Mary and Kevin (Activities triggering the different types of thinking), The Creative Collage. Critical and lateral thinking can be inculcated with a structured re programming of the neural pathways. These specially designed activities will enhance critical and lateral thinking

UNIT IV: Team Dynamics

Story boarding, Frenzy, Come to my Island, Striking Cars, Defend the Egg, Tallest Tower (Activities on the different stages of team building, team communication, coordination and collaboration)

Unit V : Mini Project

Individual projects on topics provided by faculties.

SEMESTER IV

SEMESTER IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
BS	Multi-variable Calculus	C	3	0	0	3

Unit I

Vector and Matrices, Vectors, Dot product, Determinants; cross product, Matrices; inverse matrices, Square systems; equations of planes, Parametric equations for lines and curves, Velocity, acceleration, Kepler's second law

Unit II

Partial Derivatives
Level curves; partial derivatives; tangent plane approximation, Max-min problems; least squares, Second derivative test; boundaries and infinity, Differentials; chain rule, Gradient; directional derivative; tangent plane, Lagrange multipliers,Non-independent variables, Partial differential equations

Unit III

Double integral and line integrals in the plane
Double integrals, Double integrals in polar coordinates; applications, Change of variables, Vector fields and line integrals in the plane, Path independence and conservative fields, Gradient fields and potential functions, Green's theorem, Flux; normal form of Green's theorem, Simply connected regions

Unit IV

Triple integrals in 3D
Triple integrals in rectangular and cylindrical coordinates,Spherical coordinates; surface area, Vector fields in 3D; surface integrals and flux, Divergence theorem: applications and proof.

Unit V

Surface integral in 3D
Line integrals in space, curl, exactness and potentials, Stokes' theorem, Topological considerations, Maxwell's equations.

Books of Study:

1. Edwards, Henry C., and David E. Penney. Multivariable Calculus. 6th ed. Lebanon, IN: Prentice Hall, 2002.
2. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edn., Pearson Education India, 1996.

Books of Reference:

1. T. M. Apostol, Calculus - Vol.2, 2nd Edn., Wiley India, 2003.

SEMESTER IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ENG 211	Signals and Systems	C	3	0	0	3

Objective: To provide an introduction to the concepts of signals and systems including a significant fraction of the course focusing on signal representation, signal processing, and basic concepts of linear systems.

UNIT I: Basic Introduction

Introduction to continuous-time (CT) and discrete-time (DT) signals and systems. Definitions and classification of signals. Definitions and classification of systems including linear-time-invariant (LTI) systems.

UNIT II: Representation of Periodic Signals

CT and DT Fourier series representation of periodic signals.

UNIT III: Representation of Aperiodic Signals

CT and DT Fourier Transforms as an extension to Fourier series. Laplace Transforms.

UNIT IV: Sampling and Signal Processing

NY Quist sampling theorem, Discrete Fourier Transforms, Fast Fourier Transforms, and introduction to filters

UNIT V: Linear Feedback Systems

Introduction to concepts of linear systems including stability and control

Books of Study:

1. V. Oppenheim, A. S. Willsky, and S. Hamid Nawab, Signals & Systems, 2nd Ed, Prentice Hall, 1996

References:

1. B. P. Lathi, Linear Systems and Signals, 2nd Ed, Oxford University Press, 2005
2. C. T. Chen, Signals and Systems, 3rd Ed, Oxford University Press, 2004

SEMESTER IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Design and Analysis of Algorithms	C	3	0	2	4

UNIT I

Algorithmic thinking & motivation with examples, Reinforcing the concepts of Data Structures with examples.

UNIT II

Complexity analysis of algorithms: big O, omega, and theta notation, Analysis of Sorting and Searching: Insertion sort, Selection sort, Heap sort, Recursive and non-recursive algorithms

UNIT III

General Problem Solving (GPS) techniques: Divide and conquer: Merge sort, Quicksort, BST, Master method for Complexity analysis Greedy method: Fractional Knapsack, Minimum spanning trees (Prim's & Kruskal's), shortest paths: Dijkstra's, Huffman coding- Dynamic Programming: 0/1 Knapsack, All-to-all shortest paths

UNIT IV

BFS & DFS, Backtracking: 8-Queens problem, Knights tour, Travelling Salesman Problem (TSP), Branch-and-bound: 16-puzzle problem, TSP

UNIT V

Non-polynomial complexity: examples and analysis, Vertex cover, Set cover, TSP, 3-SAT

Books of Study:

1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", 3rd Edition, MIT press, 2009
2. Parag Dave & Himanshu Dave, "Design and Analysis of Algorithms", Pearson Education, 2008

Reference books:

1. A V Aho, J E Hopcroft, J D Ullman, "Design and Analysis of Algorithms", Addison-Wesley Publishing.
2. Algorithm Design, by J. Kleinberg and E. Tardos, Addison-Wesley, 2005
3. Algorithms, by S. Dasgupta, C. Papadimitriou, and U. Vazirani, McGraw-Hill, 2006

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Computer Organization and Architecture	C	3	1	2	4

UNIT I: Basic Structure of Computers

Functional units – Bus structures – Instruction set architecture: Instruction formats - addressing modes - Architecture and instruction set of 8086/8088 microprocessor- Assembly language programming - Fixed point and floating point operations – ALU design

UNIT II: Basic Processing Unit

Fundamental concepts – Execution of a complete instruction – Hardwired control – Micro programmed control design - Nano programming- CISC-RISC- principles

UNIT III: Pipeline Processing

Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Pipeline optimization techniques: Compiler techniques for improving performance

UNIT IV: Memory System

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements –Associative memories-Secondary storage devices.

UNIT V : I/O Organization

Accessing I/O devices – Programmed Input/output - Interrupts – Direct Memory Access– Interface circuits – Standard I/O Interfaces - I/ O devices and Processors.

Books of Study:

1. Computer System Architecture, Morris Mano, Third edition, Pearson publications
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, V Edition, McGraw-Hill publications
3. “Computer Organization and Architecture – Designing for Performance”, William Stallings, Ninth edition, Pearson publications

References:

1. Structured Computer Organization, Andrew S. Tanenbaum
2. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”

3. John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill
4. V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson Education

SEMESTER IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Object Oriented Programming	C	3	0	2	4

UNIT I: Object-Oriented Thinking

A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling. Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance-specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

UNIT II: Stream Based I/O

The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.

UNIT III: Exception Handling

Fundamentals of exception handling, Exception types, Termination or presumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT IV: The Collections Framework

Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable, Properties, Stack, Vector More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

UNIT V: GUI Programming with Swing

Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.

Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes.

A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, painting in Swing, A Paint example, Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.

Books of Study:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

References:

1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
4. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
5. Java Programming and Object Oriented Application Development, R. A. Johnson, Cengage Learning.

SEMESTER IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CDC	Soft Skills 3	C	1	0	0	1

Objective

A grasp over numeric skills enable an individual to apply the mathematical techniques to situations that call for the interpretation or evaluation of quantitative information. The logical ability is sharpened through the practice of quantitative reasoning. Emotional intelligence on the other hand enables the development of intra and interpersonal relationship skills. Both these disciplines are aimed at enhancing the professional and personal effectiveness of the students.

UNIT I Quantitative Reasoning (12 hours)

Number properties (3), Speed, Time and work (2), Powers and roots (1), Pipes, cisterns (1). Problems on Clock, Calendar and Cubes (3), Height and Distance (1) , Logarithms (1)

UNIT II Non-Verbal Reasoning(7 hours)

Alpha-numerical sequence puzzle, Symbols and their relationships, Blood Relations, Seating Arrangement, Coding-Decoding, Input- Output, test Direction Sense Test

UNIT III Data Analysis and Interpretation (10 hours)

Sets and Functions (1) , Data Sufficiency (2), Statistics: Average, Median, Mode, Range, Standard deviation (2), Graphical and Numerical Methods for Describing Data, Interpretation of data in tables and graphs (2), Permutations and Venn diagrams Counting Methods, Probability (3).

UNIT IV Emotional Intelligence II

Self-Awareness, Self-Regulation, Social Skills, Empathy and Motivation.

Books of Study:

1. R.S. Agarwal, A Modern Approach to Verbal & Non Verbal Reasoning, S. Chand Publication
2. P. Anand, Quantitative Aptitude, Wiley, 2015

References:

1. The Games People Play, Eric Berne; Grove Press; 1964
2. Of Human Interaction; Joseph Luft; Mayfield Publishing. 1969
3. Emotional Intelligence; Daniel Goleman; Bantam Books, 1995

SEMESTER V

SEMESTER V

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ES	Probability and Statistics	C	3	0	0	3

Unit I: Data and Descriptive Statistics

Types of data, visualization of data, basic concepts of sample space, sample mean, and other statistics, introduction to regression

Unit II: Probability and Random Variables

Probability space, random variables, cumulative distribution function, probability density function, expectation, variance

Unit III: Random Vectors & Random Processes

Random vectors, joint PDF, covariance, correlation, independence, random processes, Markov chains

Unit IV: Computer Simulations & Monte Carlo Methods

Simulation of random variables, vectors, and processes; Monte Carlo method

Unit V: Statistics

First and higher order linear and nonlinear differential equations, existence, and solution methods

Reference Books:

1. M. Baron, Probability & Statistics for Computer Scientists, Chapman & Hall/ CRC, 2018
2. J. Johnson, Probability & Statistics for Computer Science, Wiley, 2004
3. S. Ross, Introduction to Probability & Statistics, Academic Press, 2004

SEMESTER V

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Operating Systems	C	3	0	2	4

UNIT I: Operating Systems Overview

Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II : Process Scheduling

Processes-Process Concept, Process Scheduling, Operations on Processes, Inter process Communication; CPU Scheduling algorithms; OS – examples

UNIT III: Process Synchronization And Deadlocks

Threads- Overview, Multithreading Models; Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors; Deadlocks- OS examples

UNIT IV: Storage Management

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; OS examples

UNIT V: I/O Systems

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management- OS examples

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc.
2. William Stallings, “Operating Systems – Internals and Design Principles”, 9th Edition, Pearson publications. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson

SEMESTER V

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Formal Languages and Automata Theory	C	3	0	0	3

UNIT – I

Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non-deterministic finite automaton, transition diagrams and Language recognizers. Finite Automata with output- Moore and Melay machines.

UNIT – II

Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, Ambiguity in context free grammars. Minimization of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL.

UNIT – III

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata. Equivalence of CFL and PDA.

UNIT – IV

Introduction to Turing Machines-Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines.

UNIT – V

Undecidability: A Language that is Not Recursively Enumerable, An Undecidable Problem that is RE, Undecidable Problems about Turing Machines, Post's Correspondence Problem, Other Undecidable Problems, Intractable Problems: The Classes P and NP, An NP-Complete Problem.

Text Books:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.

Reference Books:

1. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
4. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
5. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

SEMESTER V

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Computer Networks	C	3	0	2	4

UNIT - I

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model. Physical Layer: Guided transmission media, wireless transmission media. Data Link Layer - design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window prorocol

UNIT - II

Multi Access Protocols - ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

UNIT - III

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing alhorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

UNIT - IV

Inter-networking: Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses, CIDR, IMCP, ARP, RARP, DHCP.

Transport Layer: Services provided to the upper layer's elements of transport protocol-addressing connection establishment, connection release, Connection Release, Crash Recovery.

UNIT - V:

The Internet Transport Protocols UDP-RPC, Real Time Transport Protocols, The Internet Transport Protocols- Introduction to TCP, The TCP Service Model, The TCP Segment

Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.

Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH

Text Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

References Books:

1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Edition.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
3. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
4. Computer Networks, L. L. Peterson and B. S. Davie, 4th edition, Elsevier.
5. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

SEMESTER V

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CDC	Soft Skills 4	C	1	0	0	P/F

UNIT I: Quantitative Reasoning

Number properties (3), Speed, Time and work (2), Powers and roots (1), Pipes, cisterns (1). Problems on Clock, Calendar and Cubes (3), Height and Distance (1) , Logarithms (1)

UNIT II: Non-Verbal Reasoning

Alpha-numerical sequence puzzle, Symbols and their relationships, Blood Relations, Seating Arrangement, Coding-Decoding, Input- Output, test Direction Sense Test

UNIT III: Data Analysis and Interpretation

Sets and Functions (1) , Data Sufficiency (2), Statistics: Average, Median, Mode, Range, Standard deviation (2), Graphical and Numerical Methods for Describing Data, Interpretation of data in tables and graphs (2), Permutations and Venn diagrams Counting Methods, Probability (3).

UNIT IV: Emotional Intelligence II

Self-Awareness, Self-Regulation, Social Skills, Empathy and Motivation.

Books of Study:

3. R.S. Agarwal, A Modern Approach to Verbal & Non Verbal Reasoning, S. Chand Publication
4. P. Anand, Quantitative Aptitude, Wiley, 2015

References:

4. The Games People Play, Eric Berne; Grove Press; 1964
5. Of Human Interaction; Joseph Luft; Mayfield Publishing. 1969
6. Emotional Intelligence; Daniel Goleman; Bantam Books, 1995

SEMESTER VI

SEMESTER VI

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Database Management Systems	C	3	0	2	4

UNIT I

Introduction to data models and data base internals The hierarchical, network and relation models, relational schemas and introduction to data base internals.

UNIT II

Database operators and query processing, Relational algebra, calculus and introduction to SQL

UNIT III

Data base designER modelling, database design and Normalization (1NF,2NF, 3NF and BCNF, 4NF)

UNIT IV

Transaction Management and Concurrency Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management

UNIT V

Database Recovery and advanced concepts

Database recovery protocols, Logging, WAL and ARIEs, Distributed databases, parallel databases and scientific databases

Text Books:

1. Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems. 3rd ed. McGraw-Hill, 2002. ISBN: 9780072465631.

Books of reference:

1. Heller stein, Joseph, and Michael Stonebreaker. Readings in Database Systems (The RedBook). 4th ed. MIT Press, 2005. ISBN:9780262693141.

SEMESTER VI

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
BS	Differential Equations	C	3	0	0	3

UNIT I: First Order Differential Equation

Geometric meaning of $y' = f(x, y)$, Direction Fields, Euler's Method, Classification of ODEs (Linear, Non-linear, Exact, Separable), Integrating Factor, Bernoulli Equations, Initial Value Problem, Modelling (Free falling object, Radioactivity, RL-circuit).

UNIT-II : Second and Higher Order Linear ODEs

Homogeneous Linear ODEs, Modelling of Free Oscillations of a Mass-Spring System, Euler-Cauchy Equations, Non-homogeneous ODEs, Variation of Parameters, Modelling (Forced Oscillations, Electric Circuits),

UNIT-III: System of ODEs:

Modelling Engineering problems (Electric Network, Mixing problem in two tanks etc.) as systems of ODEs, Wronskian, Phase-Plane Method, Critical Points & Stability, Qualitative Methods for Nonlinear Systems, Nonhomogeneous Linear Systems of ODEs.

UNIT-IV: Series Solutions of ODEs

Introduction to power series method, Legendre's equation & polynomials, Frobenius Method, Bessel's Equations & Functions.

UNIT-V: Laplace Transforms:

Laplace transforms of standard functions, ShiftingTheorems, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Inverse Laplace transforms, Convolution theorem (without proof). Application: Solutions of ordinary differential equations using Laplace transforms.

Book of Study:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Book of References:

1. Mary L. Boas, Mathematical Methods in Physical Sciences, 3rd Edition, Wiley-India.

2. G. F. Simmons, Differential Equation with Applications and Historical Notes, TATA McGraw Hill.
3. S. Vaidyanathan, Advanced Applicable Engineering Mathematics, CBS Publishers.

SEMESTER VI

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Software Engineering	C	3	0	2	4

UNIT I : Software Process and Agile Development

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II: Requirements Analysis and Specification

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets-Data Dictionary.

UNIT III: Software Design

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV : Testing and Maintenance

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V : Project Management

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

Text Books:

1. Roger S. Pressman, Software Engineering – A Practitioner‟s Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.

2. Ian Sommerville, Software Engineering, 9th Edition, Pearson Education Asia, 2011.

References:

1. Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited, 2009.
2. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
3. Kelkar S.A., Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, Software Engineering, Tata McGraw-Hill Publishing Company Limited,2007.

SEMESTER VI

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Compiler Design	C	3	0	2	4

UNIT I: Introduction to Compilers

Translators-Compilation and Interpretation-Language processors-The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics.

UNIT II : Lexical Analysis

Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions- Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III: Syntax Analysis

Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies- Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item- Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language .

UNIT IV : Syntax Directed Translation and Run Time Environment

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker- Equivalence of Type Expressions-Type Conversions. RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation-Parameter Passing-Symbol Tables-Dynamic Storage Allocation-Storage Allocation in FORTAN.

UNIT V : Code Optimization and Code Generation

Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis- Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

Books of Study

1. Compilers – Principles, Techniques and Tools, Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, 2 nd Edition, Pearson Education, 2007.

Books of References

1. Optimizing Compilers for Modern Architectures: A Dependence-based Approach,Randy Allen, Ken Kennedy, Morgan Kaufmann Publishers, 2002.
2. Advanced Compiler Design and Implementation, Steven S. Muchnick, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 200
3. Engineering a Compiler,Keith D Cooper and Linda Torczon, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Crafting a Compiler with C,Charles N. Fischer, Richard. J. LeBlanc, Pearson Education, 2008.

SEMESTER V

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CDC-305	Interview Handling Skills – I (Soft skills-5)	Mandatory	1	0	0	P/F

Objective: With the increase in the college graduation rates the competition for the job race is increasing exponentially. Failing at an interview can take a student a step behind. It is very important to create that lasting impression on the mind of the recruiter. The curriculum is meticulously structured to groom the students in way so that they can meet the three Cs – Competency, Compatibility and Chemistry – as expected by the corporate world.

UNIT I : Resume Writing

The difference between resume and CV, Types of resume, Inclusions in a resume, Technicalities of a resume.

UNIT II: Cover Letter

Resume Vs Cover Letter, Types of cover letter, Structure of cover letter, Content of cover letter

UNIT III : Business Writing

Four types of Business Writing: Instructional, Informational, Persuasive and Transactional

UNIT IV: Creating A Personal Brand

Creating a communication strategy based on:
Who are you?
What do you offer?
What makes you unique?

UNIT V : Practice Sessions and Assessments

SPECIALIZATION STREAMS

[Artificial Intelligence and Machine Learning]

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSEC	Introduction To Machine Learning	E	3	0	2	4

UNIT I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation
Linear Regression: Introduction, Linear regression, Python exercise on linear regression

UNIT II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision Tree.

Instance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: forward search, backward search, univariate , multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA

Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes
Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem, python exercise on SVM

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm, python exercise on neural network
Introduction to Computational Learning Theory: Introduction, sample complexity, finite hypothesis space, VC dimension

UNIT V

Ensembles: Introduction, Bagging and boosting

Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering

Text Book

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

Reference Books

1. Introduction to Machine Learning Edition 2, by Ethem Alpaydin
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Principles of Soft Computing	E	3	0	2	4

UNIT - I

Introduction to Soft Computing, Artificial Neural Network (ANN) : Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, Learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perceptron, Adaline, Madaline, Multi Layer Perceptron, Feed forward Back propagation Network : back propagation learning, Learning Effect of Tuning parameters of the Back propagation

UNIT - II

RBF Network, Associative memory: Auto, hetero and linear associative memory, network, Adaptive Resonance Theory: ART1, ART2, Introduction to Computer vision, Introduction to Convolutional neural network, Popular architectures: AlexNet, GoogleNet, VGG Net

UNIT - III

Fuzzy Logic : Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule based reasoning

UNIT - IV

Genetic Algorithms: Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling : Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications , Real life Problems. Particle Swarm Optimization and its variants.

UNIT - V

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

Text Book :

1. Principles of Soft Computing- S.N.Sivanandan and S.N.Deepa, Wiley India, 2nd Edition,2011

Reference Book :

1. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI
2. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Visual Information Processing	E	3	0	2	4

UNIT – I

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels,

Image acquisition and Pre-processing: Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening

UNIT – II

Filtering in the Frequency Domain: basic filtering in the frequency domain, image smoothing and sharpening

Image Restoration: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function

UNIT – III

Image segmentation: Fundamentals, point, line detection, basic edge detection techniques, Hough transform, Thresholding, basic global threholding, optimal thresholding using Otsu's method, multi-spectral thresholding, Region based segmentation, region growing, region splitting and merging.

UNIT – IV

Color Image Processing: color models, Color transformation
Image Compression: Fundamentals, Some basic compression methods

UNIT – V

Image Representation: Shape features (Region-based representation and descriptors), area, Euler's number, eccentricity, elongatedness, rectangularity, direction, compactness, moments, covex hull, texture features, color features.

Object and Pattern Recognition: Pattern and pattern classes, Matching, minimum distance or nearest neighbor classifier, matching by correlation, Optimum statistical classifier, Neural network classifier.

Text Books:

1. R.C. Gonzalez, R.E. Woods, Digital Image Processing, 3rd Edition, Pearson Education

Reference Books:

1. S.Sridhar, Digital Image Processing, Oxford University Press, 2011
2. Milan Sonka, Vaclav Hlavac and Roger Boyele,Image processing, analysis, and machine vision. 3e, Cengage Learning, 2014.
3. Computer Vision A modern approach, David A. Forsyth and Jeam Ponce, Pearson Education

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Artificial Intelligence	E	4	0	0	4

Unit-I

Introduction: What is Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents.

Unit-II

Search: Introduction to Search, Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, current-best-hypothesis search, least commitment search

Unit-III

Knowledge Representation and Reasoning: Inference, Propositional Logic, Predicate Logic (first order logic), Logical Reasoning, Forward &Backward Chaining, Resolution; AI languages and tools - Lisp, Prolog, CLIPS

Unit-IV

Problem Solving:Formulating problems, problem types, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

Unit-V

Learning: Overview of different forms of learning, decision trees, rule based learning, neural networks, reinforcement learning.

Game playing: Perfect decision game, imperfect decision game, evaluation function, minimax, alpha-beta pruning.

Text Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
3. E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education
4. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002

SPECIALIZATION STREAMS

[Cyber Security]

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Network Security	E	3	0	2	4

Unit-I:
Need for Security, Security Attack, Security Services, Information Security, Methods of Protection. Network Concepts, Threats in Networks, Network Security Controls.

Unit-II:
Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

Unit-III:
Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET), Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats.

Unit-IV:
Firewalls: Firewalls – Types, Comparison of Firewall Types, Firewall Configurations.

References:

1. Network Security and Cryptography, Bernard Menezes, Cengage Learning.
2. Introduction to Network Security: Neal Krawetz, Cengage Learning.
3. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition.
4. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Mobile and Wireless Security	E	3	0	2	4

UNIT I

Fundamentals of Wireless & Mobile Systems: key features and mechanisms of wireless and mobile systems, Security Standards in current Wireless & Mobile Systems: WiFi Security (WEP, WPA, WPA-Enterprise); Cellular Security (GSM, 3G, LTE); Internet of Things / Wireless Sensor Networks / RFID, Emerging Privacy concerns: location, tracking, traffic analysis, mobile and the cloud.

UNIT II

Wireless and Mobile as a Cyber Physical Infrastructure (CPS), Denial of Service Attacks Cellular, WiFi, GPS, Implications to CPS: e.g., Electricity grid, Internet of Things

UNIT III

Security of Mobile Computing Plaforms, Android and iOS security models, Threats and emerging solutions (e.g., side channel attacks)

UNIT IV

Security of GSM Network, Security of UMTS Networks, Android Security Model, IOS Security Model, Security Model of the Windows Phone, SMS/MMS, Mobile Geolocation and Mobile Web Security, Security of Mobile VoIP Communications, Emerging Trends in Mobile Security

References:

1. Noureddine Boudriga, Security of Mobile Communications, 2010.
2. Levente Buttyán and Jean-Pierre Hubaux, Security and Cooperation in Wireless Networks, 2008. [Available Online]
3. James Kempf, Wireless Internet Security: Architectures and Protocols, 2008.
4. Android Security Internals: An In-Depth Guide to Android's Security Architecture, Author: Nikolay Elenkov, No Starch Press, First Edition, Nov. 2014

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Internet Protocols and Networking	E	3	0	2	4

Unit I

Network Models: Layered Tasks, The OSI Model, Layers in OSI Model, TCP/IP Protocol suite, Addressing. Connecting devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

Unit II

Principles of Internetworking, Connectionless Interconnection, Application Level Interconnection, Network Level Interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Routers TCP, UDP & IP: TCP Services, TCP Features, Segment, A TCP Connection, Flow Control, Error Control, Congestion Control, Process to Process Communication, User Datagram, Checksum, UDP Operation, IP Datagram, Fragmentation, Options, IP Addressing: Classful Addressing, IPV6.

Unit III

Data Traffic, Congestion, Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Source Based Congestion Avoidance, DEC Bit Scheme, Quality of Service, Techniques to Improve QOS: Scheduling, Traffic Shaping, Admission Control, Resource Reservation, Integrated Services and Differentiated Services.

Unit IV

Concepts of Buffer Management, Drop Tail, Drop Front, Random Drop, Passive Buffer Management Schemes, Drawbacks of PQM, Active Queue Management: Early Random Drop, RED Algorithm.

References:

1. Douglas. E.Comer, "Internetworking with TCP/IP ", Volume I PHI
2. Behrouz A Forouzan, "TCP/IP Protocol Suite", TMH, 3rd Edition
3. B.A. Forouzan, "Data communication & Networking", TMH, 4th Edition

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Introduction to Cryptography	E	3	0	2	4

UNIT I

History and overview of cryptography, Overview of cryptography. What is a cipher?, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT II

Block ciphers, Attacks on block ciphers, Block Cipher Principles, The Data Encryption Standard (DES), Block Cipher Design Principles, Block cipher modes of operation, The Euclidean Algorithm, Finite Fields of the Form GF(2^n), Advanced Encryption Standard (AES), Stream Ciphers, RC4.

UNIT III

Testing for Primality, The Chinese Remainder Theorem, The RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT IV

Cryptographic Hash Functions, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

References:

1. Stallings, William. Cryptography and network security, 4/E. Pearson Education India, 2006.
2. D. Stinson Cryptography, Theory and Practice (Third Edition)
3. Handbook of Applied Cryptography by A. Menezes, P. Van Oorschot, S. Vanstone

SPECIALIZATION STREAMS

[Data Science]

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Introduction to Data Science	E	3	0	2	4

UNIT I

Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT II

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm) - Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT III

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT IV

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT V

Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

Books and Reference:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
6. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science. (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
7. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
8. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Big Data	E	3	0	2	4

UNIT I

Big Data introduction - Big data: definition and taxonomy - Big data value for the enterprise - Setting up the demo environment - First steps with the Hadoop "ecosystem" – Exercise- The Hadoop ecosystem - Introduction to Hadoop - Hadoop components: MapReduce/Pig/Hive/HBase - Loading data into Hadoop - Handling files in Hadoop - Getting data from Hadoop Exercises – Exercise

UNIT II

Querying big data with Hive - Introduction to the SQL Language - From SQL to HiveQL – Exercises

UNIT III

Querying big data with Hive - Introduction to HIVE e HIVEQL - Using Hive to query Hadoop files - Exercises

UNIT IV

Big data & Machine learning - Quick into to Machine learning - Big Data & Machine Learning - Machine learning tools - Spark & SparkML- H2O - Azure ML - Exercises

UNIT V:

Big data and Machine learning - Big Data & Machine Learning (continued) - Next steps in the big data world Exercises - A case study- Software used : Apache Hadoop

Reference:

1. Big Data and Hadoop- Learn by Example Paperback – Import, 1 Jan 2018 by Mayank Bhushan (Author)
2. Data Analytics Made Accessible, by A. Maheshwari
3. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die by E. Siegel
4. Big data. Architettura, tecnologie e metodi per l'utilizzo di grandi basi di dati, A. Rezzani, Apogeo Education, 2013 Hadoop For Dummies, Dirk deRoos, For Dummies, 2014
5. Big Data Paperback – 20 May 2017 by Anil Maheshwari (Author)
6. Big Data Paperback – 20 May 2017 by Anil Maheshwari (Author)

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Machine Learning	E	3	0	2	4

UNIT I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation
Linear Regression: Introduction, Linear regression, Python exercise on linear regression

UNIT II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision Tree
Instance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: forward search, backward search, univariate , multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA
Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes
Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem, python exercise on SVM

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm, python exercise on neural network
Introduction to Computational Learning Theory: Introduction, sample complexity, finite hypothesis space, VC dimension

UNIT V

Ensembles: Introduction, Bagging and boosting
Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering

Text Book

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

Reference Books

1. Introduction to Machine Learning Edition 2, by EthemAlpaydin
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Inference and Representation	E	3	0	2	4

UNIT – I

Introduction- Bayesian networks- Probability review - Bayesian network basics- Probabilistic Programming and Bayesian Methods - Algorithm for d-separation-PyMC3 tutorial – Introduction to Probabilistic Topic Models - Probabilistic modelling in neuroscience - political science - Review of case studies and BN structure learning - Undirected graphical models - Conditional random fields, Gaussian MRFs Case study : Astronomy (Dan Foreman-Mackey)- Some subtleties on BNs, MRF review, CRF introduction

UNIT II

Exact inference - Variable elimination, treewidth, belief propagation Graph separation in MRFs, revisiting CRFs, BP, pruning barren nodes - Unsupervised learning Expectation Maximization Case study - Monte-Carlo methods - Gibbs sampling - Causal inference & Bayesian additive regression trees

UNIT III

Topic modelling - Introduction to Probabilistic Topic Models - Case study : Musical influence via dynamic topic models - Modelling musical influence with topic models - Gaussian processes - Application to predicting wind flow - Learning Markov random fields - Moment matching, Chow-Liu algorithm, pseudo-likelihood - Case study : Cognitive science Idea - Exponential families, learning MRFs, and GPs - An Introduction to Conditional Random Fields - Approximate maximum entropy learning in MRFs

UNIT IV

Variational inference - Mean-field approximation - Graphical models, exponential families, and variational inference - Learning deep generative models - Stochastic variational inference, Variational auto-encoder - Structured prediction - Overview of structured prediction, parameterizing CRFs - Integer linear programming - MAP inference, linear programming relaxations, dual decomposition - Derivation relating dual decomposition & LP relaxations - Integer Programming for Bayesian Network Structure Learning

References

1. Kevin Murphy, Machine Learning: a Probabilistic Perspective, MIT Press, 2012. You can read this online for free from NYU Libraries. We recommend the latest (4th) printing, as earlier editions had many typos. You can tell which printing you have as follows: check the inside cover, below the "Library of Congress" information. If it says "10 9 8 … 4" you've got the (correct) fourth print.
2. Daphne Koller and Nir Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press, 2009.
3. Mike Jordan's notes on Probabilistic Graphical Models
4. MIT lecture notes on algorithms for inference.
5. Probabilistic Programming and Bayesian Methods for Hackers by Cam Davidson Pilon
6. Trevor Hastie, Rob Tibshirani, and Jerry Friedman, Elements of Statistical Learning, Second Edition, Springer, 2009. (Can be downloaded as PDF file.)6
7. David Barber, Bayesian Reasoning and Machine Learning , Cambridge University Press, 2012. (Can be downloaded as PDF file.)

GENERAL COMPUTER SCIENCE ELECTIVES

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Image Processing	E	3	0	0	3

UNIT-I: Fundamentals of Digital Image Processing

Introduction to digital image processing - Applications of digital image processing- Steps in digital image processing- Image acquisition- sampling and quantization- Types of digital images and its representation- Basic relationships between pixels-Image transformations- Image interpolation techniques.

UNIT-II: Image Enhancement

Introduction to image enhancement- Gray level transformations –Histogram processing –Enhancement using arithmetic and logic operations - Introduction to Spatial filtering - Smoothing spatial filters - Sharpening spatial filters-Image enhancement in the frequency domain- Smoothing and sharpening in frequency domain.

UNIT-III: Image Segmentation

Introduction to image segmentation - Applications of image segmentation - Point detection - Line detection - Edge detection techniques - Edge linking and boundary detection - Image thresholding for segmentation - Region growing segmentation - Region splitting and merging approach for segmentation

UNIT-IV: Morphological Image Processing

Erosion- Dilation - Opening- Closing - Hit or miss transform - Boundary extraction - Region filling algorithm – Thinning – Thickening – Skeletonization - Morphological reconstruction

UNIT-V: Image Compression

Introduction for image compression - Need for compression - Classification of image compression schemes - Error-free compression techniques – Lossy compression techniques – Image compression standards.

Text Book:

1. Gonzalez, Rafael C. "Richard E. woods, “Digital image processing”, Prentice hall Publishers.

References:

1. Pitas, Ioannis, “Digital image processing algorithms and applications”, John Wiley & Sons.
2. William K Pratt, “Digital Image Processing”, John Wiley & Sons, Inc.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Data and Web Mining	E	3	0	0	3

Unit I:

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics. Data Mining Goals .Stages of the Data Mining Process, Data Mining Techniques , Knowledge Representation Methods. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations

Unit II:

Data preprocessing: Data cleaning .Data transformation , Data reduction. Data mining knowledge representation, Attribute-oriented analysis. Data mining algorithms: Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently , Correlation analysis.

Unit III:

Data mining algorithms: Classification, Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm ,Decision trees , Covering rules. Data mining algorithms: Prediction , The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models.

Unit IV:

Web crawling: Basic crawler algorithm, Focused crawlers, Topical crawlers, Web search: Web page pre-processing, Inverted index, HITS algorithm, Page ranking algorithm, Leadership algorithm,

Unit V:

Social network analysis: Co-citation and bibliographic coupling, Community discovery. Web usage mining: Recommender systems. Mining Twitter, Mining Face book, Mining Instagram.

Text books

1. Han, J., Kamber, M., & Pei, J. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann publications.
2. Introduction to Data Mining, Vipinkumar, Michael Steinbach, Pang-Ning Tan, Person publications,2016

3. Mining the Web, SoumenChakrabarti, Elseier publications, 2002
4. Web Data Mining, Bing Liu, Second Edition, Springer publications, 2011.
5. Mining the Social Web, Mathew A. Russel, Mikhail Klassen, Third edition, Oreily publications, 2018.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Natural Language Processing	E	3	0	0	3

UNIT I : Introduction

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.

UNIT II : Word Level and Syntactic Analysis

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III: Semantic Analysis and Discourse Processing

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV : Natural Language Generation and Machine Translation

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V : Information Retrieval and Lexical Resources

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net-Stemmers-POS Tagger- Research Corpora.

Text Books:

1. Daniel Jurafsky , James H. Martin , “Speech & language processing”, Pearson publications.
2. Allen, James. Natural language understanding. Pearson, 1995.

References:

1. Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog” , Springer.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Human Computer Interaction	E	3	0	0	3

UNIT I : Foundations of HCI

The Human: I/O channels – Memory – Reasoning and problem solving - The computer: Devices – Memory – Processing and networks - Interaction: Models – frameworks – Ergonomics – styles – elements – Interactivity- Paradigms.

UNIT II: Design and Software Process

Interactive design basics – Process – Scenarios – Navigation – Screen design – Iteration and prototyping - HCI in software process – Software life cycle – Usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III : Models and Theories

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV: Mobile HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V: Web Interface Design

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Pearson Education.
2. Brian Fling, “Mobile Design and Development”, O’Reilly Media Inc. Bill Scott and Theresa Neil, “Designing Web Interfaces”, O’Reilly.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Advanced Computer Architecture	E	3	0	0	3

UNIT I: Instruction Level Parallelism

ILP – Concepts and challenges – Hardware and software approaches – Dynamic scheduling – Speculation - Compiler techniques for exposing ILP – Branch prediction.

UNIT II: Multiple Issue Processors

VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism– Hardware versus software speculation mechanisms – IA 64 and Itanium processors–Limits on ILP.

UNIT III: Multiprocessors and Thread Level Parallelism

Symmetric and distributed shared memory architectures – Performance issues – Synchronization – Models of memory consistency – Introduction to Multithreading.

UNIT IV: Memory and I/O

Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time – Main memory and performance – Memory technology. Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system.

UNIT V: Multi-Core Architectures

Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture - heterogenous multi-core processors – case study: IBM Cell Processor.

Text Book:

1. John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007.

References:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A hardware/software approach" , Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Distributed Operating Systems	E	3	0	0	3

UNIT I

Fundamentals: What is distributed operating system, issues in designing distributed operating system, Computer networks: Lan, WAN technologies, communication protocols, internetworking, Message passing: Issues in IPC by message passing, synchronization, buffering group communication, case study. .

UNIT II

Remote procedure calls: The RPC model, Implementing RPC, RPCs in heterogeneous environment, lightweight RPC, case study. Distributed shared memory: General architecture of DSM systems, Design and implementation issues of DSM, Consistency models, Replacement strategies, Advantages of DSM. .

UNIT III

Process management: Introduction, Process migration, Threads. Synchronization: Clock synchronization, event ordering, Mutual exclusion, deadlock, Election Algorithms. Resource management: Global scheduling algorithm, Task assignment, Load sharing and balancing approaches.

UNIT IV

Distributed File system: Desirable features of a good DFS, file models, file accessing models, file sharing semantics, file caching schemes, file replication, fault tolerance, atomic transactions, Design principles, Case study: Google DFS and Hadoop DFS.

UNIT V

Naming: Desirable features of a good naming system, system oriented names, object locating mechanisms, human oriented names, name caches, naming and security. Security: potential attacks, cryptography, authentication, access control, digital signatures, design principles.

.

References:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Advanced Concepts in Operating Systems, MukeshSinghal and NiranjanShivratri, McGrawhill publications, 2017
3. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Fog Computing	E	3	0	0	3

Unit I. Fog Computing

Limitation of Cloud computing, Differences between Cloud and Fog computing, What is Fog? Advantages of Fog computing, Business Models, Architecture of Fog computing, Opportunities and Challenges

Unit II: Addressing the Challenges in Fog Resources

Introduction ,Taxanomy and Characteristics , Resource Management Challenge , Optimisation challenges, Miscellaneous Challenges, IoT and Fog: Introduction . Programming paradigms for IoT+ Fog, Research challenges and Future Research Directions

Unit III: Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds

Introduction, Background ,Network Slicing in 5G , Network Slicing in Software-Defined Clouds , Network Slicing Management in Edge and Fog , Future Research Directions: Middleware for Fog and Edge Computing: Design Issues , Introduction. Need for Fog and Edge Computing Middleware: Design Goals ,State-of-the-Art Middleware Infrastructures, System Model , Clusters for Lightweight Edge Clouds , Architecture Management – Storage and Orchestration , IoT Integration, Security Management for Edge Cloud Architectures, Future Research Directions

Unit IV: Data Management and Analysis in Fog Computing

Introduction ,Background , Fog Data Management, Future Research and DirectionmMotivating Example: Smart Building , Predictive Analysis with FogTorch, Survey of ML Techniques for Defending IoT Devices, Machine Learning in Fog Computing , Future Research Directions

Unit V: Case Studies

Uscase 1: Introduction, Human Object Detection, Object Tracking, Lightweight Human Detection. Usecase 2: Introduction,Data-Driven Intelligent Transportation Systems, Mission-Critical Computing Requirements of Smart Transportation Applications, Fog

Computing for Smart Transportation Applications, Case study 3: Intelligent Traffic Lights Management (ITLM) System, Testing Perspectives

Reference book:

1. Fog and Edge Computing, RajkumarBuyya, Satish Narayana Srirama, Wiley Publications, 2019.
2. Fog computing in the Internet of Things: Springer publications, 2018

(Other reference: Research papers from IEEE, ACM, Springer and Elsevier)

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Parallel Algorithms	E	3	0	0	3

UNIT I

Sequential model, need of alternative model, parallel computational 8 models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II

Performance Measures of Parallel Algorithms, speed-up and 8 efficiency of PA, Cost-optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III

Parallel Sorting Networks, Parallel Merging Algorithms on on 8 CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC/, linear array.

UNIT IV

Parallel Searching Algorithm, Kth element, Kth element in X+Y on 8 PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V

Graph Algorithms - Connected Graphs, search and traversal, 8 Combinatorial Algorithms-Permutation, Combinations, Derrangements.

Text Books:

1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGrawHill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms” 3. S.G. Akl, ”Parallel Sorting Algorithm” by Academic Press

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Web Services	E	3	0	0	3

UNIT I

Introduction to Web Services - fundamental of web services, basic operational model of web services, Business motivations for web services, B2B, B2C, Technical motivations, basic steps of implementing web services, benefits and challenges of using web services, tools and technologies enabling web services, Web services Architecture and its characteristics, web services communication models, core building blocks of web services, web services technology stack.

UNIT II

Service–oriented Architecture (SOA), implementation view, logical view, process view, deployment view, composition of web services, from application server to peer to peer, life in the runtime.

Fundamentals of SOAP-SOAP Message Structure, SOAP encoding, Encoding of different data types, SOAP communication and messaging, SOAP message exchange models, limitations of SOAP.

UNIT III

Transport protocols for web services, messaging with web services, WSDL, Anatomy of WSDL, manipulating WSDL, web service policy, discovering web services, UDDI, Anatomy of UDDI, Web service inspection, Ad – Hoc Discovery, Securing web services.

UNIT IV

Discovering Web Services, service discovery mechanisms, role of service discovery in a SQA, UDDI-UDDI registries, uses of UDDI Registry, UDDI data structures, Programming with UDDI, Publishing, searching and deleting information in a UDDI Registry, Publishing API, limitations of UDDI.

UNIT V

Semantic Web – Role of Metadata in web content, Resource Description Framework, RDF schema, Architecture of semantic web.

Web Services Interoperability - Means of ensuring Interoperability, creating Java client for a Web service, Goals of Cryptography, Digital signature, Digital Certificate, Challenges in Web Services Interoperability. Web Services Security, XML security framework, XML Encryption.

Text Book

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.

Reference Books:

1. Java Web Service Architecture, James McGovern, Sameer Tyagi etal., Elsevier
2. Building Web Services with Java, 2 Edition, S. Graham and others, Pearson Edn.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
4. Web Services, G. Alonso, F. Casati and others, Springer.Outcomes

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Advanced Database Management Systems	E	3	0	0	3

UNIT I

Significance of Databases, Advantages and Disadvantages of different Database Management systems, Database System Applications, Comparison between DBMS, RDBMS, Distributed and Centralized Database. DCL Commands: Grant and Revoke, Transactional Control: Commit, Rollback, Save point

Types of locks: Deadlock, Shared lock, Exclusive lock, Table level locks, Row level locks

UNIT II

Basics of PL/SQL: Data types, Advantages Control Structures: Conditional, Iterative, Sequential, Cursors: Static (Implicit & Explicit), Dynamic, Procedures & Functions, Exceptions: Predefined Exceptions, User defined exceptions, Packages: Package specification, Package body, Advantages of package

Synonym: Create synonym, Sequences: Create and alter sequences, Index: Unique and composite, Views: Create/Replace, Update and alter views.

UNIT III

Basics of Functional Dependency, Functional dependency diagram and examples, Full functional dependency (FFD), Armstrong's Axioms for functional dependencies, Closures of a set of functional dependencies, Redundant functional dependencies.

Basics of Normalization, Normal Forms: First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), BCNF.

UNIT IV

Fundamentals of Database Triggers, Creating Triggers, Types of Triggers: Before, after for each row, for each statement.

Lossy Decomposition, Dependency-Preserving Decomposition, Lossless join decomposition.

UNIT V

Transaction processing: Introduction of transaction processing, advantages and disadvantages of transaction processing system, serializability and recoverability, view serializability, long duration transaction, high-performance transaction system, online transaction processing system, distributed locking, transaction management in multi-database system, resolving deadlock.

Text Books:

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

Reference Books:

1. K. V. Iyer, Lecture notes available as PDF file for classroom use.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Complexity Theory	E	3	0	0	3

UNIT I: Computability:

Review of Turing Machines, view of PDAs, 2DFAs, FAs as restricted TMs and related theorems. Tape reduction, and robustness of the model. Encoding and Enumeration of Turing Machines, Undecidability. Rice-Myhill-Shapiro theorem. Relativisation. Arithmetic and Analytic Hierarchy of languages. Proof of Godel's incompleteness theorem based on computability. Kolmogorov Complexity. Resource bounded computation. Notion of a computational resource. Blum's Speedup theorem.

UNIT II: Time Complexity

Time as a resource, Linear Speedup theorem. Crossing Sequences and their applications. Hierarchy theorems. P vs NP. Time Complexity classes and their relationships. Notion of completeness, reductions. Cook-Levin Theorem. Ladner's theorem. Relativization Barrier : Baker-Gill-Solovoy theorem.

UNIT III: Space Complexity

Space as a resource. PSPACE, L and NL. Reachability Problem, Completeness results. Savitch's theorem, Inductive Counting to show Immerman-Szelepscenyi theorem. Reachability Problems, Expander Graphs, SL=L

UNIT IV: Complexity of Counting & Randomization

Counting Problems. Theory of #P-completeness. The complexity classes PP, ParityP, BPP, RP, BPP is in P/poly, Toda's theorem.

Text Books:

1. Automata and Computability - Dexter Kozen
2. Theory of Computation - Dexter Kozen
3. Theory of Computational Complexity - Du and Ko - (Reviews) , (Errata)
4. Complexity Theory: A Modern Approach - Sanjeev Arora and Boaz Barak.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Computer Graphics and Multimedia	E	3	0	0	3

UNIT I

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices.

Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm.

UNIT II

Two Dimensional Geometric Transformation: Basic Transformation (Translation, rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.

Two Dimensional Viewing: Window-to- View port Coordinate Transformation.

UNIT III

Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).

Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Scan conversion of Character.

Polygon Filling: Seed Fill Algorithm, Scan line Algorithm.

Two Dimensional Object Representation: Spline Representation, Bezier Curves and B-Spline Curves.

UNIT IV

Fractal Geometry: Fractal Classification and Fractal Dimension.

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation.

Projections: Parallel Projection and Perspective Projection.

Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan-line Algorithm and Painters Algorithm.

UNIT V

Illumination Models: Basic Models, Displaying Light Intensities.

Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.

Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing.

Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices.

Textbook:

1. Computer Graphics with Virtual Reality System, Rajesh K.Maurya, Wiley Dreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

Reference Books :

1. Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
	Advanced Data Structures and Algorithms	E	3	0	0	3

UNIT I

Advanced Data Structures: Importance and need of good data structures and algorithms Heaps, AVL Trees (Search, Insertion, Deletion) Red-Black Trees(Search, Insertion and Deletion), Splay Trees(Search, Insertion and Deletion),B-trees, B+ Trees (Search, Insertion and Deletion), Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures

UNIT II

Algorithms Complexity and Analysis: Probabilistic Analysis with example, Amortized Analysis with example, Competitive Analysis with example, Internal and External Sorting algorithms like external merge sort, distribution sorts.

UNIT III

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, Topological sort, Max flow: Ford Fulkerson algorithm, max flow – min cut, Dynamic Graphs, Few Algorithms for Dynamic Graphs, Union-Find Algorithms.

UNIT IV

Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover Problems.

UNIT V

Randomized algorithms: Introduction, Type of Randomized Algorithms, Quick Sort, Min-Cut, 2-SAT; Game Theoretic Techniques, Random Walks.

Text Books:

1. Thomas Coremen, Introduction to Algorithms, PHI (2009).
2. David E. Goldberg, Genetic Algorithm, Pearson education (2005).
3. Roger Sedgewick and Kevin Wayne , Algorithms, Addison-Wesley Professional(2011) .

Reference Books:

1. Sahni, Sartaj, Data Structures, Algorithms and Applications in C++, MIT Press (2005)

MINOR PROGRAMME

CSE Dept. offers Minor in Computer Science and curriculum is given below.

Sl. No.	Subject Name	L-T-P	Credit
1	Object oriented programming with Java	3-0-2	4
2	Algorithm Analysis and Design	3-0-2	4
3	Web Technology	3-0-2	4
4	Database Management Systems	3-0-2	4
5	Software Engineering	3-0-2	4